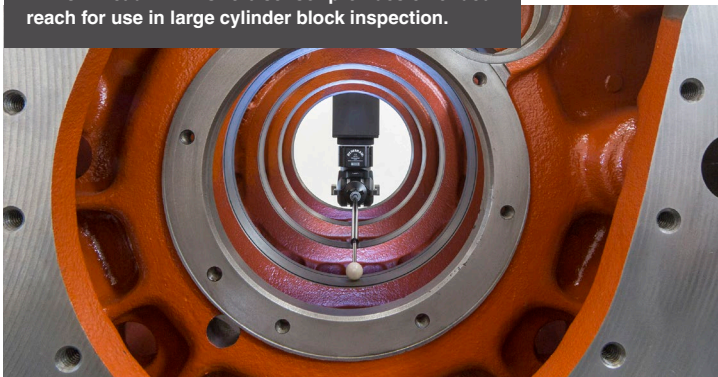


5-axis multi-sensor solution for large cylinder block inspection

A manufacturer's dilemma

As co-ordinate measuring machines (CMMs) age, they need more attention and can become problematic if not maintained correctly. This manufacturer of large diesel engine cylinder blocks was running two shifts per day on machining centres, followed by inspection on a very large gantry CMM. The machine was over 20 years old and was disrupting production with an increasing number of breakdowns as well as mounting repair costs.

REVO-2 head with RSP3-6 sensor provides extended reach for use in large cylinder block inspection.



The challenges

The largest of the engines measured 3 m x 1.5 m x 2 m with a capacity approaching 100 litres. To inspect such large engine cylinder blocks, the gantry CMM required deep reinforced concrete foundations and a large overhead crane had to be used for loading and unloading.

The CMM inspection process assessed critical features including cylinder bores, crankshaft main bearings, camshaft bearings and a variety of location holes and faces. The results were needed as quickly as possible so that the block could be passed and moved on to assembly.

The CMM was limited to capturing touch points. Faster data capture using scanning was not possible. In addition, only dimensional inspection data could be captured as there was no ability to acquire surface finish data.

The machine was increasingly a bottleneck for the two production shifts, even before breakdowns were factored in. Because there was no off-line programming capability, any new part programs or modifications had to be written on the CMM outside normal production hours.

The CMM structure and foundations were sound, but the ageing electronics, controller and measuring scales were identified as its weakest points. These proved not only to be unreliable but, in many cases, new replacements were no longer available. During some breakdowns, the only way to restore operations was to call an engineer to 'fault find', then replace individual components on circuit boards. After several breakdowns that took weeks to fix, it was time for a rethink.

The options

Three main options were considered:

- Continue to support the old CMM; this would include buying a stock of used spare parts, plus purchasing portable measuring arms as back-up inspection devices.
- Buy a new large CMM (3 m x 2 m x 1 m minimum); this would require expensive new foundations. It would also mean no inspection capability whilst the lengthy construction work and installation were completed.
- Retrofit the existing CMM; this would offer an opportunity to give the CMM brand new wiring, controller, scales and rapid scanning probes.

The solution

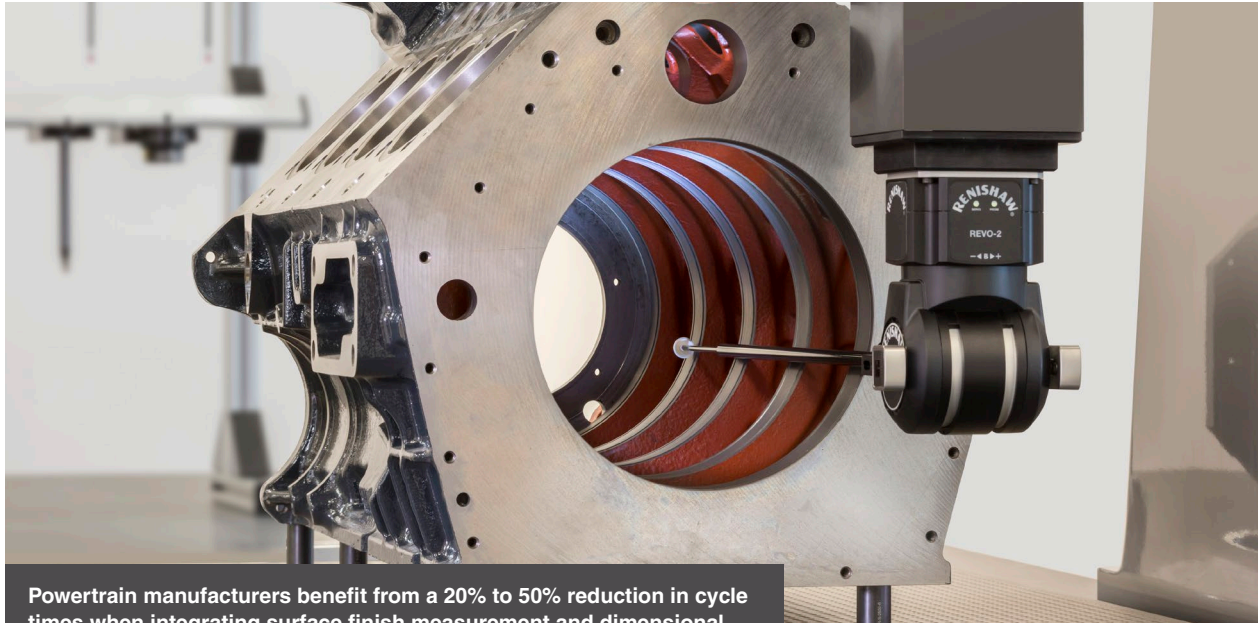
Retrofitting the existing CMM with a REVO® 5-axis measuring system was the most efficient, cost effective and long-term solution.

Only three to four weeks of machine uptime would be lost, just a fraction of the time to install a completely new machine with a concrete base, saving a considerable amount of downtime and setup costs.

The ageing controller was replaced with the latest Renishaw UCC S5 controller and SPA3 amplifier combination to improve the speed of the machine. Finally, it was fitted with a new Renishaw TONiC™ position encoder system.

This solution matched the criteria of the customer's specific situation, as it had already been identified by Renishaw that the existing CMM structure and foundations were sound. It was a more immediate, more cost effective solution to the set of challenges presented.

An immediate result of the retrofit was that the inspection time for a basic engine block was more than halved, from two hours 15 minutes to just one hour.



Powertrain manufacturers benefit from a 20% to 50% reduction in cycle times when integrating surface finish measurement and dimensional inspection on a single 5-axis measuring CMM.

Benefits

The REVO® 5-axis measuring system's scanning capability also opened up the potential to be more efficient across other functions.

By choosing the 5-axis system with infinite positioning, it was possible to measure some features that were previously inaccessible with fixed probing. Additionally, the ability to carry multiple sensors, including surface finish, had the potential to reduce manual operations using hand held gauges.

Finally, the offline programming option with Renishaw's MODUS™ metrology software enabled the programmers to work in parallel with inspection routines during normal shifts, further reducing labour costs.

Benefits at a glance:


- Shorter inspection cycle times (reductions of 20% to 50% are common)
- Earlier confirmation about upstream process changes
- Automated surface finish measurements
- Results in one digital report
- Multi-sensor capability reduces floor space requirements
- Reduced probe and styli calibration time
- More flexibility for feature access with fewer styli
- A platform for future sensors
- Elimination of bottlenecks
- Reduction in labour costs, including emergency engineer call-outs

Summary

Renishaw completed the retrofit in 2015, with the CMM operating reliably ever since. Only planned maintenance and annual calibration has been required. There was no need for expensive new foundations, they were able to avoid the costs of extended downtime and made future improvements to their manufacturing process a lot more accessible. The ability to automatically capture surface finish data has also proved to be invaluable and the faster, more comprehensive, data collection has provided the basis for a proactive assessment of the machining processes. By opting for a Renishaw retrofit with REVO 5-axis technology, the customer has streamlined its entire part inspection process whilst eliminating the bottlenecks that were so prominent prior to this.

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